# Entergy Services, Inc.

***Deployment and Integration of Synchro Phasor Technology***

## Abstract

Entergy's Deployment and Integration of Synchro Phasor Technology project is deploying phasor measurement units (PMUs), phasor data concentrators (PDCs), and state of the art decision support tools across Louisiana, Mississippi, Arkansas, and non-ERCOT portions of east Texas. These capabilities will enhance grid visibility of the bulk power system in near real-time, enable detection of disturbances which may produce instabilities or outages, and facilitate sharing of information with neighboring regional control areas. Additionally, the project will focus on training and education throughout the operations and engineering groups at Entergy to provide the foundational learning required to implement these advanced tools.

## Smart Grid Features

***Communications infrastructure*** includes enhancements to the deployment of network communication switches and substation computers within the Entergy Phasor network. The PMUs, substation computer, and communications equipment will be housed within the Secure Phasor Platform—an 11-gauge aluminum enclosure with two 600-lb locks, key card security access, and a 19" swing frame rack. The Entergy Phasor system will connect 41 PMUs with Entergy's grid operations center.

*A **wide-area monitoring and visualization system*** enables a more expansive view of the bulk transmission system while revealing dynamic operating details. Entergy expects this information to help identify grid disturbances and possibly reduce the impact of adverse system events.

### At-A-Glance

**Recipient: Entergy Services, Inc.**

**States: Louisiana, Arkansas, Mississippi, and non-ERCOT East Texas**

**NERC Region: SERC Reliability Corporation**

**Total Budget: $9,222,402**

**Federal Share: $4,611,201**

**Project Type: Electric Transmission Systems**

**Equipment**

- **41 Phasor Measurement Units across 21 Substations**
- **21 Substation Computers**

**Advanced Applications**

- **Angle/Frequency Monitoring**
- **Post-Mortem Analysis**
- **Voltage Stability Monitoring**
- **Oscillation Monitoring**
- **Enhanced State Estimation**
- **Pattern Recognition**
- **Open Phasor Gateway**
- **Wide-Area Visualization System**

**Key Targeted Benefits**

- **Reduced Operating and Maintenance Costs**
- **Reduced Greenhouse Gas Emissions**

Through the project, Entergy is implementing ***advanced transmission applications*** for the synchrophasor system, including:

- **Angle and frequency monitoring** capabilities provide grid operators and engineers with detailed information about grid conditions.
- **Post-mortem analysis** enables power system engineers and grid operators to analyze historical disturbances and system events to better understand their causes.
- **Voltage stability monitoring** applications provide novel information about the stability of the Entergy system.
- **Oscillation monitoring** provides information about potential or growing oscillations near and within the Entergy system.

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- **Pattern recognition** software analyzes Entergy's historical PMU information to determine if patterns exist that are precursors to voltage stability events.
- **Enhanced state estimation** incorporates phasor measurements to assist in the observability of the system and in resolving the identification of critical measurements.
- **Open phasor gateway** provides secure and reliable transmission of high bandwidth, high frequency phasor information between Entergy and other utility companies.
- **Open phasor data collector** gathers high-speed phasor data from all PMUs; time aligns the PMU data and sends the data to all the requesting entities.
- **Wide-area visualization system** collects and displays information collected from all of the phasor analytics, provides a Google-earth representation of the Entergy and external grids with layers for weather, phase angle differences, hurricane tracking, oscillation monitoring, voltage stability monitoring, and state estimator results visualization.

## Timeline

| Key Milestones | Target Dates |
|---|---|
| Visualization system installation completed | Q1 2013 |
| Communications enhancements completed | Q2 2013 |
| PMU/PDC deployment completed | Q2 2013 |
| Advanced transmissions applications installation completed | Q2 2013 |
| Substation computers installation complete | Q2 2013 |
| Cyber Security and Infrastructure efficiency reviews completed | Q2 2013 |
| Education and training completed | Q2 2013 |

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